Wisconsin
Department of Commerce

Evaluation # 200206-O

Safety & Buildings Division
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Wisconsin
Building Products Evaluation

Material	Automatic Sprinkler Head Tyco EC-25
Manufacturer	Tyco Fire Products 1467 Elmwood Avenue Cranston, RI 02910
Provided by	TVA Fire & Safety, Inc. 3300 Highlands Parkway, Suite 135 Smyrna, GA 30082

SCOPE OF EVALUATION

In accordance with the current edition of the Wisconsin Administrative Building And Heating, Ventilating And Air Conditioning Code: The Tyco EC-25 automatic sprinkler head was evaluated as a component of a automatic fire sprinkler system, and a component of a automatic fire suppression system, in accordance with the definitions in **s. Comm 51.01(7a)** and **s. Comm 51.01(7b)**, respectively. The Tyco EC-25 automatic sprinkler head was evaluated in accordance with the general requirements of **s. Comm 51.23(1)**.

In accordance with the Wisconsin Amended ICC 2000 Code (**eff. 7/01/02**): The Tyco EC-25 automatic sprinkler head was evaluated as a component of a automatic fire sprinkler system, and a component of a automatic fire suppression system, in accordance with **s. 903.1**.

DESCRIPTION AND USE

The Model EC-25 Extended Coverage Upright Sprinklers are “Control-Mode Extended Coverage Sprinklers” having a nominal K-Factor of 25.2. These sprinklers offer maximum coverage areas of 14 feet by 14 feet (196 sq. ft.).

The Model EC-25 Extended Coverage Upright Sprinklers are identified by SIN TY9128. Technical data: maximum working pressure of 175 psi (12, 1 bar). Pipe thread connection: 1 inch NPT or ISO 7-R1. The discharge coefficient: K=25.2 GPM/psi$^{1/2}$ (362, 9 LPM/bar$^{1/2}$). Temperature ratings: 165° F/74° C or 214° F/101° C. The finish is natural brass.

The physical characteristic of the Model EC-25 utilizes a dezincification resistant bronze alloy frame with a copper or brass deflector. The strut and hook are monel. The two halves of the fusible link assembly are nickel. The button is made of brass and the compression screw is stainless steel. The frame orifice is sealed with a gasket spring plate (Belleville Seal) consisting of a beryllium nickel disc spring that is sealed on both its inside and outside edges with a Teflon gasket. See Figure 1 below.

TESTS AND RESULTS

The Model EC-25 extended coverage upright sprinklers are Factory Mutual approved, Underwriter's Laboratories Inc. and C-UL listed. Approvals and listings are under the name of Tyco Fire Products and **only apply** to the service conditions indicated in the Large-Scale Fire Tests Of Retail Shelf Display And Rack Storage Of Cartoned Group A Plastics Utilizing Extended Coverage Sprinklers Having A Nominal K-Factor Of 25.2. Prepared by Underwriter's Laboratories Inc. (Project 00NK22528, NC4119), for the RETAIL FIRE RESEARCH COALITION, excerpted below:

Series "A" Testing, High Shelf Storage
This was a series of six large-scale tests for each specific retailer's arrangements. It was understood by The Technical Advisory Committee (TAC), that each arrangement was unique enough to require its own individual test, and that the series as a whole would then provide enough data to allow for engineering judgement regarding any future adjustments to those arrangements.

Test Protocol and Conclusions

- Test #1 (**Wal-Mart**):
  Nominal 12-ft. storage of Group A plastic under a 22-ft. ceiling. The main storage

array consisted of 78-in. high steel shelving units with a 24-in. depth. Solid steel shelves were positioned at 24-in., 48-in. and 78-in. above the floor.
The test demonstrated that Group "A" Plastic commodities displayed on steel cantilever-style retail shelving can be protected by a sprinkler system designed to supply a 0.425 gpm/sq.ft. discharge density over a 2000 sq.ft. area, without the use of in-rack sprinklers, if the following guidelines are met:

- Storage height does not exceed 12-ft. on gondola shelving with metal shelves
- Ceiling height does not exceed 22-ft.
- Gondola structure does not exceed 48-in. in aggregate depth, or 78-in. in height
- Maintain minimum aisle width of 5-ft.
- EC-25 sprinklers are provided in accordance with their listing.

♦ Test #2 (**Best Buy**):

Nominal 15-ft. storage of Group A plastic under a 25-ft. ceiling. The main storage array consisted of 96-in. high steel shelving units with a 30-in. depth on the bottom tier and 25.5-in. depth on the second and third tier. Solid steel shelves were positioned at 33-in. and 63-in. and had a perforated metal deck at 96-in. spanning across the top of the shelving unit.

The test demonstrated that Group "A" Plastic commodities displayed on steel cantilever-style retail shelving can be protected by a sprinkler system designed to supply a 0.425 gpm/sq.ft. discharge density over a 2000 sq.ft. area, without the use of in-rack sprinklers, if the following guidelines are met:

- Storage height does not exceed 15-ft. on gondola shelving with metal shelves
- Ceiling height does not exceed 25-ft.
- Gondola structure does not exceed 60-in. in aggregate depth, or 8-ft. in height
- Maintain minimum aisle width of 6-ft.
- EC-25 sprinklers are provided in accordance with their listing.

♦ Test #3 (**Target Stock Room**):

Nominal 15-ft. storage of Group A plastic under a 20.5-ft. ceiling. The three main storage arrays consisted of ¾-in. thick 24-in. deep solid particleboard shelving suspended on steel uprights at 14-in., 28-in., 42-in., 56-in., 70-in., 84-in., 98-in., 112-in., 126-in. and 144-in.

The test demonstrated that Group "A" Plastic commodities displayed in single-row or double-row upright-style solid shelving can be protected by a sprinkler system designed to supply a 0.425 gpm/sq.ft. discharge density over a 2000 sq.ft. area, without the use of in-rack sprinklers, if the following guidelines are met:

- Storage height does not exceed 15-ft.
- Ceiling height does not exceed 20-ft./-6-in.
- Shelving structure does not exceed 48-in. in aggregate depth, or 12-ft. in height
- Maintain minimum aisle width of 3-ft.
- EC-25 sprinklers are provided in accordance with their listing.

♦ Test #4 (**Office Depot**):

Nominal 13.5-ft. storage of Group A plastic under a 20-ft. ceiling. The main storage array consisted of 30-in. deep high steel shelving unit with solid steel shelving at 46-in. and positioned under a 30-in. deep, 120-in. high steel rack unit with wire shelving at 76-in. and 120-in.

The test demonstrated that Group "A" Plastic commodities displayed on steel cantilever-style retail shelving with racking above can be protected by a sprinkler system designed to supply a 0.38 gpm/sq.ft. discharge density over a 2000 sq.ft. area, without the use of in-rack sprinklers, if the following guidelines are met:

- Storage height does not exceed 14-ft.
- Ceiling height does not exceed 20-ft.
- Maintain minimum aisle width of 5-ft.
- Maintain minimum longitudinal flue spaces of 6-in.
- EC-25 sprinklers are provided in accordance with their listing.

♦ Test #5 (**Bed Bath & Beyond**):

Nominal 16.5-ft. storage of Group A plastic under a 22-ft. ceiling. The main storage array consisted of 3/4-in. thick 24-inch deep high solid veneered particleboard shelving suspended on wire uprights at 48-inches and 96-inches with a wire shelf at 148 inches.

The fire was controlled in this test but, did not meet the success parameters of this research program because an excessive number of sprinklers operated. This was due to inadequate water density (0.425) and shielding of commodity in a void space formed by the perpendicular intersection of racks. Since this void space does not normally have commodity in it, and barriers can be provided to prevent commodity from falling into it, a sixth test was added with a higher density (0.49) and no commodity in the void space. This test was successful.

♦ Test #6 (**Bed Bath & Beyond**):

Nominal 16.5-ft. storage of Group A plastic under a 22-ft. ceiling. The main storage array consisted of 3/4-in. thick 24-inch deep high solid veneered particleboard shelving suspended on wire uprights at 24-inches, 48-inches, 72-inches, 96-inches and 120-inches with a wire shelf at 148 inches.

The test demonstrated that Group "A" Plastic commodities displayed in steel uprights with particleboard laminate shelving can be protected by a sprinkler system designed to supply a 0.49 gpm/sq.ft. discharge density over a 2000 sq.ft. area, without the use of in-rack sprinklers, if the following guidelines are met:

- Storage height does not exceed 16-ft. 6-in.
- Ceiling height does not exceed 22-ft.
- Gondola structure does not exceed 51-in. in aggregate depth, or 12-ft. 4-in. in height
- Intersection of perpendicular shelf units is acceptable
- No storage within void space at junction of perpendicular shelf units
- Maintain minimum aisle width of 4-ft. between shelf unit and other displays
- EC-25 sprinklers are provided in accordance with their listing (with maximum 14-ft x 14-ft. spacing.

Series "B" Testing

High Rack Storage

A primary goal of Series "B" was to investigate the various retail display arrangements that are prevalent in the stores and determine which ones, if any, cause a significant increase in hazard to the standard rack array. It was important to determine if any of these displays compromise the sprinkler protection provided.

Calorimeter Testing

Since there were several arrangements that the Coalition wanted to address, it was agreed that testing under the 10MW calorimeter could be used as a first step in the research. Five "scoping tests" were performed to compare the heat release rates of each display type in question and compare these results to the baseline rack array utilized in previous full-scale fire tests. All tests were performed with standard "A" plastic test commodity, and were approximately seven-and-a half feet wide by 16 feet long by eight feet high.

- Scoping Test #1: Baseline test – Two-feet-by-six-feet transverse slatted shelves with two-inch spacers on racks. Set baseline standard to compare other tests to.
- Scoping Test #2: Pegboard placed over slatted shelves on racks. The TAC determined that the use of pegboard placed horizontally on top of the slatted shelves caused a hazard increase. The burning in the array indicated a significant horizontal fire spread that could over-challenge the sprinkler system in a full-scale array, therefore full-scale testing was not recommended.
- Scoping Test #3: "Bulkhead" or solid vertical and horizontal displays within racks. The results of this test proved to be comparable to the baseline standard. The TAC decided to conduct a full scale test of this arrangement.
- Scoping Test #4: Vertical pegboard with product hanging on metal pegs. This display arrangement did not prove challenging. This arrangement indicated significantly lower heat release rates and fire growth than the baseline test, and further testing was not recommended.
- Scoping Test #5: Perforated metal covering over slatted shelving on racks. Unlike pegboard over slatted shelving, perforated metal provided a less challenging fire than the scoping test. A full-scale test was proposed utilizing this covering.

Test Protocol and Conclusions

Based on the calorimeter tests and the goals of the coalition, Series "B" included the following four full-scale tests:

- Test #1 (**The Home Depot, HomeBase**): Baseline slatted shelf rack arrangement proven in previous test programs, with the exception that the ceiling height was increased from 27 feet to 30 feet, and the commodity height was increased from 20 feet to 22 feet.

  The test demonstrated that Group "A" Plastic commodities displayed in single-row or double-row racks will be adequately protected by sprinkler systems designed to supply a 0.60 gpm/sq.ft. discharge density over a 2000 sq. ft. area, without the use of in-rack sprinklers, if the following guidelines are met:
  - Storage height does not exceed 22-ft.
  - Ceiling height does not exceed 30-ft.
  - Maintain minimum aisle width of 8-ft.
  - Maintain minimum longitudinal flue spaces of 6-in. and transverse flue spaces of 3-inches at rack uprights
  - EC-25 sprinklers are provided in accordance with their listing
  - Install slatted shelving with 2-inch gaps on all levels except the top rack; Install wire mesh at top.

- Test #2 (**Sam's Club**): Rack storage arrangement with a solid display shelf placed at approximately 4 feet and 6 feet above finished floor, as is commonly seen in Sam's Club.

  The test demonstrated that Group "A" Plastic commodities displayed in single-row or double-row racks will be adequately protected by sprinkler systems designed to supply a 0.60 gpm/sq.ft. discharge density over a 2000 sq. ft. area, without the use of in-rack sprinklers, if the following guidelines are met:

- Storage height does not exceed 22-ft.
- Ceiling height does not exceed 30-ft.
- Maintain minimum aisle width of 8-ft.
- Maintain minimum longitudinal flue spaces of 6-in. and transverse flue spaces of 3-inches
- EC-25 sprinklers are provided in accordance with their listing.
- Install one solid shelf within each rack bay between flue spaces for display purposes, with open shelving on other levels.

♦ Test #3 (**The Home Depot, HomeBase**): Slatted-shelf rack array with perforated metal shelving **(3,808 holes 0.50-inch diameter, resulting in an open area of approximately 43 percent)** placed over slats at picking levels and pallets of "A" plastic commodity in the aisle to simulate aisle displays.

The test demonstrated that Group "A" Plastic commodities displayed in single-row or double-row racks will be adequately protected by sprinkler systems designed to supply a 0.60 gpm/sq.ft. discharge density over a 2000 sq. ft. area, without the use of in-rack sprinklers, if the following guidelines are met:

- Storage height does not exceed 22-ft.
- Ceiling height does not exceed 30-ft.
- Maintain minimum aisle width of 8-ft.
- Maintain minimum longitudinal flue spaces of 6-in. and transverse flue spaces of 3-inches at rack uprights
- EC-25 sprinklers are provided in accordance with their listing
- Install slatted shelving with 2-inch gaps on all tiers except top of rack (perforated sheet metal covering over slats is allowed)
- Incidental storage of commodity within the aisle is allowed. **The aisle display shall provide a minimum width of 4 feet between the aisle display and the opposing rack face**.

♦ Test #4 (**The Home Depot, HomeBase**): Standard rack array with bulkhead displays built into the ignition bay and adjacent bays. These displays were located higher in the rack than normal to allow a larger than normal amount of Group "A" plastics underneath.

The test demonstrated that Group "A" Plastic commodities displayed in single-row or double-row racks will be adequately protected by sprinkler systems designed to supply a 0.60 gpm/sq.ft. discharge density over a 2000 sq. ft. area, without the use of in-rack sprinklers, if the following guidelines are met:

- Storage height does not exceed 22-ft.
- Ceiling height does not exceed 30-ft.
- Maintain minimum aisle width of 8-ft.
- Maintain minimum longitudinal flue spaces of 6-in. and transverse flue spaces of 3-inches at rack uprights
- EC-25 sprinklers are provided in accordance with their listing with maximum 2 foot by 12 foot spacing
- Install slatted shelving with 2-inch gaps on all levels except top of rack; Install wire mesh at top
- Solid displays (vertical and/or horizontal) within each rack bay between flue spaces for display purposes are acceptable.

Where the FM Approval is utilized, it can be noted that the EC-25 has successfully undergone full-scale fire testing at FM for use under obstructed ceiling conditions for area/density design applications.

LIMITATIONS OF APPROVAL

The Tyco EC-25 automatic sprinkler head is approved for use as tested (see TESTS AND RESULTS of this evaluation). The Tyco EC-25 automatic sprinkler head shall be installed in accordance with the general requirements of **s. Comm 51.23(1)** and **section 903** of the current Wisconsin Administrative Building And Heating, Ventilating And Air Conditioning Code, and the Wisconsin Amended ICC 2000 Code (**eff. 7/01/02**), respectively.

The Tyco EC-25 automatic sprinkler head is approved for use and shall be maintained in accordance with **52.01(2)(h)**.

When used as a component of an automatic fire sprinkler system the Tyco EC-25 automatic sprinkler head shall conform to the requirements of **s. Comm 52.011(4)**.

Note: Under the **Series "A" Testing, Test #3 through #6,** a **minimum** ceiling clearance height of **8 feet shall be maintained.**

This approval will be valid through December 31, 2006, unless manufacturing modifications are made to the product or a re-examination is deemed necessary by the department. The Wisconsin Building Product Evaluation number must be provided when plans that include this product are submitted for review.

DISCLAIMER

The department is in no way endorsing or advertising this product. This approval addresses only the specified applications for the product and does not waive any code requirement not specified in this document.

Revision Date:

Approval Date: January 29, 2002 By: _____

Lee E. Finley, Jr.
Product & Material Review
Integrated Services Bureau

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